REMARKS

All claims stand rejected under 35 USC 102 and/or 35 USC 103 over Yamazaki et al. Claim 16 has been amended to include the features of claim 24. Thus, claim 16 is now limited to the fin material being formed by continuous strip casting, a first cold rolling step, strand annealing and a second cold rolling step. These treatment steps are different from those disclosed by Yamazaki et al and result in the alloy having superior properties relative to those of the allow disclosed by Yamazaki et al.

Applicant respectfully submits that claim 16, as now amended, is patentable over Yamazaki et al. In support of this position, applicant submits herewith the declaration of Larz Ignberg, who is qualified as an expert in the subject on which he testifies. Accordingly, the opinion of Mr. Ignberg must be accorded weight in evaluating patentability of claim 16.

The macroscopic properties of metals or metal alloys, henceforth denoted 'metals', depend on the microstructure of the metal. The microstructure is determined from the type, shape, size and interconnectivity of the grains forming the metal. For example, smaller grains usually give a harder metal. Other macroscopic properties affected by the microstructure are for example tensile strength, toughness, conduction, ductility etc.

There are two major contributions that determine the formation and appearance of the microstructure and grains in a metal. The first contribution comes from the constituents forming the metal, that is, the contents of different elements constituting the metal. Different elemental contents may give grains having different crystal structures, or phases, which phases may have different properties. The grains may also be of different types or have different phases within the same metal, so that two or more phases co-exist. In particular, the elemental content may vary between different grains in the same metal. Hence the total elemental content of a metal does not necessarily by itself determine the types of grains in the metal.

The second contribution determining the formation and appearance of the microstructure and grains in a metal is the formation and treatment of the metal. The formation of a metal comprises different forms of casting, forging and similar. The treatments a metal may be subjected to comprise for example quenching, annealing, tempering, cold-working, hot-working, etc. Each formation or treatment operation will affect the grains inside the metal and will contribute to forming different properties for the metal. In several instances the same treatment operation will also give different results depending on both the previous treatment or formation operations performed on the metal and on the constituents of the metal.

Hence, two metals having the same elemental contents may be completely different depending on how the metals have been formed and treated during the manufacturing of the metals. As an example cast iron having the same elementary content may form gray cast iron or white cast iron, having totally different properties, solely depending on the cooling rate during the casting operation. The specification of the constituents of a metal hence only gives an indication in the direction of the type and properties of the metal. In order to fully specify a metal the formation and treatment of the metal must also be specified, and much investigation, research and inventive work may be needed to find formation and treatment operations that give a particular metal alloy desired properties.

Soldering and brazing are methods for joining two metal members, which methods comprises heating and liquefying a brazing or solder metal placed in contact with and in between the metal members. The brazing or solder metal must have a melting temperature well below the melting temperature of the metal in the metal members. The liquid metal is then allowed to solidify, which joins the metal members together. Soldering is performed in a rather low temperature, usually between 302° F to 572° F (150-300° C). Brazing however, is performed at a higher temperature, usually between about 1112° F to 1652° F (600-900°

C), and gives a stronger joint than soldering. Due to the high brazing temperature higher demands are set on a material that is to be brazed rather than soldered. Furthermore, the brazing step in itself is expected to change the grain structure and thus the properties of the metal.

Yamazaki et al seeks to provide a metal having characteristics that are suitable for solder coating treatment. Alloy number 20 in Table 1 of Yamazaki et al contains Cr and has a half-softening temperature of 732° F (390° C).

Since brazing is normally performed at a temperature above 1112° F (600° C), it is apparent that alloy number 20 of Yamazaki et al is not suitable to allow brazing. Brazing the alloy disclosed by Yamazaki et al would subject the alloy to temperatures well above its half-softening temperature, which would soften the alloy to such a degree that the alloy could not be used in most applications, and at least not in an application for an automotive heat exchanger.

In order to achieve the metal according to the Yamazaki reference the metal has been treated according to the following (column 2, Yamazaki):

1) Melting and mixing of constituents
2) Casting (in batches)
3) Heating to 400 °C and hot rolling
4) Cooling with water
5) Cold rolling
6) Heat-treatment at 450 °C for 1 h
7) Cold rolling
8) Annealing at 300 °C for 1 h.

Such a treatment scheme thus gives a metal, which is not suitable for use in brazing applications.

The metal produced by the method according to the present invention comprises a copper metal alloyed with Cr, which is intended for use in fins brazed to radiator tubes. The tubes must be brazed in order to achieve a strong joint that withstands the

high pressures used in modern radiator tubes. The metal must therefore withstand the high brazing temperature in excess of 1112° F (600° C) without weakening. The metal must also withstand being subjected to a long-term heating to about 150° C during the subsequent use of the radiator tube. The metal according to the Yamazaki reference does not have sufficient qualities for being able to function during these conditions.

Applicant discloses that the fin material should be formed by continuous casting, a first cold rolling, strand annealing at a temperature in the range from 700 to 900° C, and a second cold rolling. These operations produce a metal that can withstand the temperatures required for brazing. After brazing, the metal has the desired properties for use in fin material for radiator tubes.

The metal produced by the method according to the present invention can be brazed and thus used for fin material in brazed radiator tubes. The metal according to Yamazaki cannot be brazed and therefore cannot be used in brazed radiator tubes. Hence it must be considered that the present invention and the Yamazaki reference show two completely different metals, due to their different treatment schemes, even though they have some similarities concerning their total elemental contents.

The method according to the present invention has fewer steps (5 in difference to 8), than the method according to Yamazaki. Furthermore, the treatment according to the present invention comprises a strand annealing step, which is not shown at all in the Yamazaki reference. The strand annealing step comprises heating the metal to a higher temperature and for a shorter time than more common and generally used annealing operations at about 300 °C for 1 h, which is what is used for making the metal in the Yamazaki reference.

The treatment operation strand annealing is not found or described in Yamazaki, nor does Yamazaki teach anything about achieving a metal better suited for brazing by changing any of the treatment steps. In fact, Yamazaki rather gives the

impression that the given half-softening temperature of 732° F (390° C) is one of the highest half-softening temperatures attainable for the given metal.

Since the method according to the invention produces a metal that is suitable to be brazed, while the metal according to the Yamazaki reference cannot be brazed, and since the treatment operations for achieving the metals differs in a non-obvious manner, it must be considered that the metals are of such different nature that the method according to the present invention is not rendered obvious by the disclosure of Yamazaki et al.

The metal produced by the method according to the invention has the advantages of fewer and less expensive manufacturing steps, and the achievement of an alloy with higher temperature resistance, similar or higher IACS, and which is possible to braze, so that a stronger joint can be formed. These advantages are unexpected and non-derivable from the Yamazaki reference. Hence the invention should be considered as being non-obvious relative to Yamazaki, regardless of the fact that the alloys have similar constituents.

The examiner asserts with respect to claims 18 and 20-26 that use of a continuous process (i.e. continuous casting) "does not involve invention" relative to the batch operation disclosed by Yamazaki. Applicant assumes that the examiner intended to assert that it would have been obvious to a person of ordinary skill in the art in view of the batch operation disclosed by Yamazaki to employ continuous casting. Applicant submits that this is not the case where the continuous casting results in an alloy having different properties from those of the alloy produced by the batch operation. Since it is evident that the alloy produced in accordance with the method defined in claim 16 has a significantly higher tolerance for temperature than that of the alloy produced by the method disclosed by Yamazaki, and this superior characteristic is attributable to the treatment steps performed on the alloy, applicant submits that the combination of

treatment steps specified in claim 16 would not have been obvious to a person of ordinary skill in the art in view of the disclosure of Yamazaki in example 20.

The declaration of Larz Ignberg supports applicant's arguments set forth above.

In view of the foregoing, applicant submits that the subject matter defined in claim 16 is not disclosed or suggested by Yamazaki et al. Therefore, claim 16 is patentable, and it follows that the dependent claims also are patentable.

Respectfully submitted,

John Smith-Hill
Reg. No. 27,730

SMITH-HILL & BEDELL, P.C.
16100 N.W. Cornell Road, Suite 220
Beaverton, Oregon 97006

Tel. (503) 574-3100
Fax (503) 574-3197
Docket: BJE1 1584D2

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of

Mariann SUNDBERG et al

Application No: 10/821,293

Filed: April 9, 2004

For: COPPER ALLOY AND METHOD FOR ITS MANUFACTURE

Conf. No: 1106

Art Unit: 1742

Examiner: Sikyin Ip

DECLARATION UNDER 37 CFR 1.132

COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450

Sir:

I, the undersigned, Larz Ignberg, Technical Manager at Luvata Oy (formerly known as Outokumpu Copper Products Oy), hereby solemnly state that:

1. I am not the inventor and have no other interests in the invention other than as a co-employee at Luvata Oy.

2. I am an expert in the field of copper metals and its alloys. I have a M.Sc. in Materials Science and have performed extensive research and development on copper materials for over 20 years in the course of my employment.

3. It is my understanding that the examiner considers that the application indicated above is obvious departing from the document Yamazaki et al (U.S. Patent 4,710,349, hereinafter referred to as Yamazaki). The undersigned respectfully disagrees.

4. The macroscopic properties of metals or metal alloys,

henceforth denoted 'metals', depend on the microstructure of the metal. The microstructure is determined from the type, shape, size and interconnectivity of the grains forming the metal. For example, smaller grains usually give a harder metal. Other macroscopic properties affected by the microstructure are for example tensile strength, toughness, conductivity, ductility etc.

5. There are two major contributions that determine the formation and appearance of the microstructure and grains in a metal. The first contribution comes from the constituents forming the metal, that is, the contents of different elements constituting the metal. Different elemental contents may give grains having different crystal structures, or phases, which phases may have different properties. The grains may also be of different types or have different phases within the same metal, so that two or more phases co-exist. In particular, the elemental content may vary between different grains in the same metal. Hence the total elemental content of a metal does not necessarily by itself determine the types of grains in the metal.

6. The second contribution determining the formation and appearance of the microstructure and grains in a metal is the formation and treatment of the metal. The formation of a metal comprises different forms of casting, forging and similar. The treatments a metal may be subjected to comprises for example quenching, annealing, tempering, cold-working, hot-working, etc. Each formation or treatment operation will affect the grains and precipitation/solid solution of alloying elements inside the metal and will contribute to forming different properties for the metal. In several instances the same treatment operation will also give different results depending on both the previous treatment or formation operations performed on the metal and on the constituents of the metal.

7. Hence, two metals having the same elemental contents may be completely different depending on how the metals have been formed and treated during the manufacturing of the metals. As an example cast iron having the same elementary content may form grey cast iron or white cast iron, having totally different properties, solely depending on the cooling rate during the casting operation. The specification of the constituents of a metal hence only gives an indication in the direction of the type and properties of the metal. In order to fully specify a metal the formation and treatment of the metal must also be specified, and much investigation, research and inventive work may be needed to find formation and treatment operations that give a particular metal alloy desired properties.

8. The Yamazaki document cited in the office action shows a copper metal alloyed with chromium. In view of the above, however, the fact that a copper metal alloyed with chromium is known should not per se constitute a hinder towards patentability, unless the properties of the two metals are shown to be the same, which they are not in the present case as shown below.

9. Soldering and brazing are methods for joining two metal members, which methods comprises heating and liquefying a brazing or solder metal placed in contact with and in between the metal members. The brazing or solder metal must have a melting temperature well below the melting temperature of the metal in the metal members. The liquid metal is then allowed to solidify, which joins the members together. Soldering is performed in a rather low temperature, usually between 302 °F to 572 °F (150-300 °C). Brazing however, is performed at a higher temperature, usually between about 1112 °F to 1652 °F (600-900 °C), and gives a stronger joint than soldering. Due to the high brazing temperature higher demands are set on a material that is to be

brazed rather than soldered. Furthermore, the brazing step in itself is expected to change the grain structure and thus the properties of the metal.

10. The Yamazaki document shows an alloy containing Cr. The purpose of the Yamazaki reference is to indicate a metal having good half-softening temperature for the purpose of permitting soldering of the alloy. In Yamazaki it is stated that the alloy (no. 20 in table 1) has a half-softening temperature of 732 °F (390 °C). Since brazing is normally performed in a temperature above 1112 °F (600 °C), it is easily deduced that the Yamazaki metal is not of sufficient quality to allow brazing of the same. Brazing the alloy according to Yamazaki would subject the Yamazaki alloy for temperatures well above its half-softening temperature, which would soften the alloy to such a degree that the alloy would not be possible to use in most applications, and at least not in an application for radiator tubes.

11. In order to achieve the metal according to the Yamazaki reference the metal has been treated according to the following (column 2, Yamazaki):

1) Melting and mixing of constituents
2) Casting (in batches)
3) Heating to 400 °C and hot rolling
4) Cooling with water
5) Cold rolling
6) Heat-treatment at 450 °C for 1 h
7) Cold rolling
8) Annealing at 300 °C for 1 h.

Such a treatment scheme thus gives a metal, which is not possible to use in brazing applications.

12. The heat exchanger according to the present invention

comprises radiator tubes made in a copper metal alloyed with Cr, which is intended to be brazed. The tubes must be brazed in order to achieve a strong joint that withstands the high pressures used in modern radiator tubes. The metal must therefore withstand the high brazing temperature in excess of 1112 °F (600 °C) without weakening. The metal must also withstand to be subjected to a long-term heating to about (150 °C) during the subsequent use of the heat exchanger. The metal according to the Yamazaki reference does not have sufficient qualities for being able to function during these conditions.

13. The method of forming a heat exchanger according to the present invention comprises (c.f. the example in the present application):

1) Forming fin material by castinga copper-chromium alloy

2) Cold working

3) Strand annealing, that is, annealing for 0-30 seconds at 700-900 °C

4) Cold working

The formation and treatment operations according to this treatment scheme gives a metal that is suitable to braze. After brazing the metal will have the desired material properties for use in a heat exchanger.

14. The metal used in the heat exchanger according to the present invention can be brazed and thus used in brazed radiator tubes. The metal according to Yamazaki, however, cannot be brazed and used in radiator tubes. Hence it must be considered that the present invention and the Yamazaki reference shows two completely different metals, due to their different treatment schemes, even though both are copper alloys containing chromium.

15. The method for forming the metal to the heat exchanger according to the present invention has fewer steps (4 in

difference to 8), than the method according to Yamazaki. Furthermore, the treatment according to the present invention comprises a strand annealing step, which is not shown at all in the Yamazaki reference. The strand annealing step comprises heating the metal to a higher temperature and for a shorter time than more common and generally used annealing operations at about 300 °C for 1 h, which is what is used for making the metal in the Yamazaki reference.

16. The treatment operation strand annealing is not found or described in Yamazaki, nor does Yamazaki teach anything about achieving a metal better suited for brazing by changing any of the treatment steps. In fact, Yamazaki rather gives the impression that the given half-softening temperature of 732 °F (390 °C) is one of the highest half-softening temperatures attainable for the given metal. This half-softening temperature can be achieved also with other alloys. The unique issue of this patent is that it is possible to increase the half-softening temperature more than 200 °C (compared to the Yamazaki alloy) and still maintain e.g. a very high conductivity of the material. This is made by the combination of alloying and the unique formation and treatment of the metal.

17. Since the metal in the heat exchanger according to the invention is suitable to be brazed, while the metal according to the Yamazaki reference cannot be used in these applications, and since the treatment operations for achieving the metals differs in a non-obvious manner, it must be considered that the metals are of such different nature that the metal according to Yamazaki does not anticipate the metal according to the present invention.

18. The metal in the heat exchanger according to the invention has the advantages of fewer and less expensive manufacturing steps, and the achievement of an alloy with higher

temperature resistance, similar or higher IACS, and which is possible to braze, so that a stronger joint can be formed. These advantages are unexpected and non-derivable from the Yamazaki reference. Hence the invention should be considered as being non-obvious relative to Yamazaki, regardless of the fact that the alloys have similar constituents.

18. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Title 18, United States Code, Sec. 1001, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Larz Ingberg

2008-01-30

Date